Technology **Profile**

County benefits from new traffic management system

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Montgomery County, Maryland, covers an area of approximately 500 square miles and has a population of about one million people, including many dignitaries who work on Capitol Hill. The county is also home to some of the leading biotechnology companies, corporations and federal agencies in the USA. It has 4,500 center lane miles, more than 1,000 miles of emergency roads, 50 miles of interstate, and 4,000 neighborhood roads. The Montgomery County Department of Transportation (MCDOT) is responsible for ensuring that traffic flows smoothly along all these roadways. To achieve this, the MCDOT must ensure that 800 traffic signals, sensors and surveillance cameras function in harmony, all managed from the county's centralized Traffic Operation Center (TOC).

Challenges

"We've been using a real-time centralized traffic management system since the 1980s," says Michael Kinney, senior engineer at MCDOT. "However, the network was nearing the end of its useful life and the old system lacked the required resiliency. If a single component failed, for example, some or all traffic signals lost coordination, disrupting the flow of traffic."

In November 2009, things came to a head, when there was a system-wide outage, which lasted two days and made national news headlines.

"Commuting in rush hours was significantly impacted and congestion was much worse than normal during all hours of the day," explains Kinney. "In addition to the inconvenience to commuters, ensuing traffic jams wasted gas, resulting in unnecessary CO_2 emissions. It was time to replace the county's traffic management system."

However, upgrading to a modern system had to be achieved within the available budget. Fortunately, the county already had a communications infrastructure of twisted-copper covering hundreds of miles. The MCDOT had also made an ongoing investment in building a fiber ring, so any upgrade to the system had to make use of available resources and re-use this existing copper and fiber.

Montgomery County's traffic cameras, intersection controls and other elements of the traffic management system are operated by just 17 employees. Since 1980, the MCDOT has doubled the number of intersections and added 200 cameras. The number of personnel, however, remained constant, resulting in a high workload. A key specification for the new system was a reduction of the number of trips that employees had to make to manually adjust signal controller timings.

The MCDOT undertook a thorough analysis of the current traffic management system and available solutions. It developed a two-year and a six-year plan, and set a deadline for retiring the old system by 2012.

The right solution

After a thorough analysis and evaluation of several systems from a variety of vendors, the MCDOT selected Silicon Valley-based Actelis to build a network that comprised the county's new intelligent traffic system.

The Actelis system met the MCOD's specific technical and operational requirements, including the ability to function and maintain integrity in cold and hot weather, rain and snow, and even after lightning strikes, as a result of its environmentally hardened ML624i and ML688 Ethernet Access Devices (EADs).

Need to know?

The MCOD required a modern, robust traffic management system that could meet a number of requirements

- Must eliminate single points of failure
- Must re-use existing copper and fiber infrastructure
- Upgrade could not involve freeways or roadways being closed for extended periods
- Must not require additional staff or resources
- Must be compatible with battery back-up and UPS
- Must be standards compliant and IP capable

The EADs had to be able to bond multiple pairs of copper to deliver the necessary bandwidth to communicate with the controller and provide the required redundancy. Unlike other solutions evaluated by the MCDOT, if one pair failed, the network connectivity would not be lost using the Actelis solution.

The equipment is also compatible with Internet Group Management Protocol (IGMP) snooping, meaning it can logically segregate network traffic between the units and the controller, enabling more efficient bandwidth management.

The EADs and aggregation switches support both GigE fiber and high-speed Ethernet-based copper interfaces, meaning that Montgomery County's fiber ring is connected to Actelis equipment on one unit, while copper is used to connect the equipment to the signal cabinets.

The new equipment supports VLAN tagging, which allows separation of different streams of traffic. This ensures that traffic from signal controllers follows a different virtual path than a stream of traffic for WiFi access. MAC address filtering and IP access control allow Montgomery County to prevent unauthorized access to the network. In addition, support for Secure Shell (SSH) enables strong authentication and prevents malicious attacks such as IP spoofing, IP source routing and DNS spoofing.

(Left) **The ML2300 Switch** (Below left) **The ML624i Ethernet Access Device**

The MetaASSIST EMS is a Carrier-class distributed element management system (EMS), which enables the Actelis product family to integrate smoothly into existing network management systems via standard interfaces. It also enables centralized real-time planning, provisioning, monitoring and management of networks of multiple systems. The MCDOT uses the combination of these systems to collect data, report on SLA performance and troubleshoot hundreds of network elements across a large geographical area.

Results

The final topology of the network leveraged a hybrid communication network using fiber to create a ring and running laterals to the traffic controllers. The centralized command and control system enable the county to build timing plans that can be used well into the future. They also enable technicians to make signal timing adjustments – up to 60 times a day – to fine-tune the signal timing to account for accidents or roadworks.

"A practical application of this capability is if a traffic incident takes place on I-495, I-370 and I-270 (three major highways running through the county) as well as on any of the surface streets, TOC operators can quickly divert drivers to side roads and enable traffic to continue flowing smoothly," says Kinney.

Montgomery County is well on its way to achieving its goal of retiring the old signal system in 2012. With 850 network elements installed, it has not encountered any significant issues with the equipment and the solution has proven to be very reliable.

Even though the DOT's 17 traffic technicians are still very busy managing traffic across a large county, the new network has not required additional staff. In fact, the MCDOT reports that the resiliency of the new equipment and its ability to automatically recover from outages has reduced the burden placed on technicians.

Future plans

Montgomery County's TMC has become a model for implementing the right traffic management solutions. It regularly hosts tours for various cities, counties and DOT representatives to demonstrate how it has successfully upgraded legacy systems while making optimal use of the existing network infrastructure and human resources.

The success of this first phase has led to plans to increase safety and reduce public transportation journey times by instituting transit signal priority, giving buses extra green light time. Since the upgraded network can carry much higher volumes of data, the DOT is exploring the potential to replace school flashes currently operating with time-clocked devices that need manual adjustments every time the schedule changes, with ones that can be managed over the network. It is also looking into enhancing the capabilities of the network by installing sampling devices to detect traffic volume and speed.

"The ability to install and auto-manage the network allows the traffic engineers to focus on their core competency: improving the overall efficiency and effectiveness of the county's traffic system," adds Kinney.

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